Educational Technology Research and Evaluation
U.S. Department of Education

Access to information and communications technology has increased dramatically over the past decade. The National Center for Education Statistics reports that 99 percent of schools and 92 percent of instructional rooms have Internet with 94 percent of those connections being broadband. More computers are also available which have reduced student to computer ratios from 12:1 in 1998 to 4.8:1 in 2002. [1]

As the Web-based Education Commission noted, the challenge confronting the educational technology community is to invest in research and evaluation studies to better guide the effective use of this investment while also demonstrating to policymakers the impact on teaching and learning. In an effort to meet this need, the U.S. Department of Education is investing more than $56 million to study the conditions and practices under which technology is used to document its impact on student performance.

National Study
http://www.ed.gov/about/offices/list/os/technology/evaluation.html

The No Child Left Behind Act of 2001 calls for a five year, $15 million study of the effects of educational technology, using rigorous scientifically based methodologies. Congress' call for a landmark, rigorous study is consistent with other current efforts to expand the use of scientifically based methods in education research.

In October 2002, the U.S. Department of Education began working with Mathematica Policy Research, Inc. and its partners, the American Institutes for Research and the Education Development Center, to identify issues confronting a national study of technology effectiveness and to develop designs for the study. A key part of the design effort was to engage a panel of outside experts on educational technology, educational policy, and research methodology, to help identify important questions to be addressed in the study and to suggest possible approaches for answering them. Designing such a study is a significant undertaking. No study of education technology has used experimental methods on a large scale. Important considerations must be addressed: how the study's questions should be focused, how to structure the design for measurement and resource efficiency, and how to collaborate with schools and districts. Rapid innovations in computing technology, changes in the education policy context created by No Child Left Behind itself, and the goal of ensuring that knowledge from the study is immediately useful for schools and teachers contribute to the challenges. In May 2002, the Design Team provided the following recommendations:

> **Question: What is "educational technology?"**
> Recommendation 1: Examine technology applications designed to support teaching and learning.
> Recommendation 2: Use a public submission process to identify technology applications to study.

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[1]United States Department of Education, National Center for Education Statistics. ""Internet Access in U.S. Public Schools and Classrooms: 1994-2002." October 2003. http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2004011

Question: What is "effective?"
Recommendation 3: Use experimental designs to measure effects.
Recommendation 4: Study the effects of technology applications for schools or teachers that do not currently use the applications but are interested in using them.
Recommendation 5: Design the study to detect "moderate" to "large" effects of technology applications.

Question: What kinds of students?
Recommendation 6: Study the effects of technology applications for students in the primary and secondary grade levels (K-12).
Recommendation 7: Study the effects of technology applications for schools that are eligible to receive Title I funds.

Question: What is "academic achievement?"
Recommendation 8: Study the effects of technology applications on student academic achievement as measured by commonly used standardized tests, and collect data on other academic indicators to provide a fuller picture.
Recommendation 9: Study the effects of technology applications that support instruction in reading and math.

In September 2003 Mathematica Policy and their subcontractor, SRI International were awarded a three-year, $10 million contract to conduct the actual study. This team brings together expertise with randomized assignment research and the topic of educational technology. The Team will immediately begin the work of identifying the technology interventions and schools that will participate in the study.

National Educational Technology Trends Study (NETTS)

NETTS will examine program implementation in schools receiving federal Enhancing Education Through Technology (EETT) grants authorized under the No Child Left Behind (NCLB) Act of 2001, with a particular emphasis on understanding how and to what extent the EETT program helps further the goals of NCLB. In addition, the study will collect data relevant to EETT program performance, as detailed in Department of Education's Strategic Plan.

Evaluation Questions
1. How do States differ in their plans and strategies for using EETT funds?

2. What types of entities are receiving EETT funds (a) under the Competitive program and (b) under the Formula grant program?

3. How are subgrantees using EETT funds?

4. Are school uses of EETT funds supporting program goals?

   a. Is the EETT program helping to close the gap between high- and low-poverty schools in students' and teachers' actual access to technology?

   b. Is the EETT program supporting teachers, principals, and school administrators in effective integration of technology into curricula and instruction?

NETTS will also investigate how access, support for and use of educational technology vary by school poverty rates and other key factors, and whether EETT funds have improved integration of technology in districts of high poverty. The study is sponsored by the U.S. Department of Education, Policy and Program Studies Services, and is being conducted by SRI Center for Technology in Learning, American Institutes for Research, and the Urban Institute.

Evaluating State Educational Technology Program (ESTEP)

The purpose of the grant program is to increase the capacity of States to design, conduct and procure high-quality evaluations of educational technology. To do so, the ESETP grant competition provides more than $17 million over the next three years to States to

(1) plan and conduct a scientifically based evaluation of an educational intervention that uses technology applications as a tool to increase student achievement in one or more core academic subjects
(2) test and document the methods, practices, and instruments used to assess the impact of the intervention on student achievement
(3) make available to other states documented information about the evaluation plan, its implementation.

The Department of Education through the School Support and Technology Programs Office and the Office of Educational Technology made grant awards to 10 State Education Agencies:

Arkansas Department of Education
Evaluation of the EAST Initiative (Environmental and Spatial Technology)
$1.8 million over three years
This project will assess the nature, quality and intensity EAST program implementation strategies and processes and their relative outcomes on teachers' attitudes, classroom practices and content knowledge, and students' attitudes, skills, and achievement. East involves the creation of interdisciplinary school-based technology labs that promote student intellectual growth and technology skills acquisition and teacher training on facilitating student learning through service projects and teamwork. The study will involve 120 projects serving 9,000 students (55% rural, 25% suburban, and 20% urban setting). Study results will yield deeper insights into specific participant, environmental and program characteristics that appear to influence student and outcomes. In addition, an evaluation sustainability study will assess the extent to which the project's dissemination and capacity building activities are serving to the capacity of Arkansas and other States to plan, conduct and procure high-quality evaluations.

Iowa Department of Education
Using Technology to Support the Scaling-Up of the Iowa Professional Development Model
$1.9 million over three years
This project will use the Iowa adopted a professional development model based on best practices as the basis for scaling-up an educational intervention system using experimental, quasi-experimental randomized classroom trials, and will seek to demonstrate that scientifically based teacher training on best practices using technology must be causally linked to the implementation of those practices in the classroom in order for the impact to be observed in student achievement in math and reading. This multi-agency, statewide field research effort will focus on reading and mathematics instructional practice in the 6th, 7th and 8th grades in 150 public

school districts, including 43 high need districts as defined by No Child Left Behind. The project will yield a research model for identifying and scaling up teacher training on best practices.

Maine Department of Education
The Impact of Teachers' Professional Development on the Mathematics Achievement of Low-Performing Rural Students in Technology-Rich Classrooms
$1.9 million over three years
The Maine evaluation use and experimental design with randomized assignment of schools to treatment and control conditions to investigate the impact of intensive, multi-faceted professional development on teacher classroom practices, student and teacher use of technology to enhance mathematics learning, and student mathematics achievement. The study will focus on 7th and 8th grade students in schools that serve low-income rural communities and that have shown low performance in 8th grade mathematics. The study promises to contribute to research-based knowledge of effective practices in mathematics education and technology integration, ubiquitous computing, professional development and education in low-income rural schools.

North Carolina Department of Public Instruction
LANCET: Looking at North Carolina Educational Technology
$1.5 million over three years
The LANCET project will use experimental, quasi-experimental, and case study designs to study the implementation of the State's IMPACT model and its effects on schools, teaching practices, and student achievement. IMPACT is professional development model. The project will develop and assess strategies for building the capacity for educators across the State to collect, analyze and use evaluation data for making decisions about technology programs, projects, and practices, and will disseminate the strategies, methods, instruments and protocols used in and resulting from the project.

Pennsylvania Department of Education
Evaluation of Student and Parent Access Through Recycled Computers (eSPARC)
$1.8 million over three years
The *e*SPARC study project seeks to develop and test an evaluation model and can be used by local and State educational agencies to measure the impact of educational technology initiatives. The project will randomly assign recycled computers to a sample of 400 5th grade students and their families. The study will assess whether and how in-home computer and Internet access impact students and patents and will produce and disseminate research methods and tools that can be used to measure the impact of technology initiatives across program areas.

Tennessee Department of Education
The Tennessee EdTech Accountability Model (TEAM)
$1.7 million over three years
The project will measure effectiveness of an intervention to prepare school-based technology coaches to work with teachers on methods of aligning technology use to the delivery of the curriculum using instructional materials that foster increased student achievement. The project will measure effectiveness of the intervention in 37 schools; develop a replicable, validated evaluation protocol for use in all schools, and disseminate the results and instruments, nationally.

Texas Education Agency
Evaluation of the Texas Technology Immersion Pilot (eTxTIP)
$1.9 million over three years

TXTIP is a State mandated technology immersion pilot that seeks to increase student achievement by providing each student with a wireless mobile computing device, software, and online and other learning resources. The TxTIP evaluation will test the effectiveness of technology immersion in increasing middle school students' achievement in core academic subjects, technology proficiency, attitudes and attendance, as well as the effect on the school environment, personnel and parent and community partnerships. Approximately, 38,000 students and 2,700 teachers in about 60 randomly assigned middle schools will participate in the evaluation.

West Virginia Department of Education
ED PACE: Educational Development for Planning and Conducting Evaluations
$1.4 million over three years

The *ED PACE* will employ a quasi-experimental design with experimental elements to assess student achievement in virtual foreign language courses as compared to the achievement of students in classroom based foreign language courses. Over the course of three years, the project will generate three scientifically based research models (a summative research model, a formative research model, and an action research model) that can be replicated in other settings used at local, state, and national levels to measure the impact of other technology enhanced interventions on student achievement and validate their effectiveness.

West Virginia Department of Education
The Evaluation of West Virginia's Enhancing Education Through Technology Model School Project
$1.3 million over three years

The project will assess the outcomes for teachers and students of West Virginia's ESEA Title II, Part D school-based teacher trainer initiative. The study will employ an experimental research design and make use of technology based desktop meters and random interval data collection pop-up screens to document the use, time, topic and function budgets of teachers and students. These methods will yield objective, detailed information about classroom integration of technology as an outcome of professional development and the impact of technology integration practices on student performance on West Virginia's tests of standards-based content. In year 3, data from the study will be used to explore the extent to which evaluation data is used by state policy makers to inform decisions.

Wisconsin Department of Public Instruction
A Study of the Effectiveness of Three Models of Implementing Educational Technology
$1.6 million over three years

The Wisconsin project will: (a) identify from existing data three promising models of educational technology use in schools in the State, (b) implement the models using the Title II, Part D competitive grant process, (c) and evaluate the effectiveness of the models on student achievement using quasi- experimental methods to assign experimental and control group, and student portfolios, student self-reports, and standards-based knowledge assessments to measure student achievement.

Institute of Education Sciences Funded Projects

Total dollars: **$26,640,663**
Range: **$250,000 to $5,999,744**

CAST, Inc.
Principal Investigator: Dr. Bridget Dalton
Reading to learn: Investigating general and domain specific supports in a technology-rich environment with diverse readers learning from informational text
Students today must be able to comprehend complex text, including material presented in a multi-media, web-based format. This research team will develop a computer-based instructional approach that will support readers at risk for literacy difficulties and will accelerate their development of reading comprehension, especially for informational text. In addition, the researchers will determine how the genre of text being read (narrative vs. science), the way in which the text is presented (multi-media website vs. digital text only), and how varying computer-based supports affect text comprehension by both struggling and average urban fourth-grade readers.

University of Colorado
Principal Investigator: Dr. Thomas Landauer
Research on and with novel educational technologies for comprehension
Learning to read and comprehend at a high level requires a large vocabulary. However, acquiring a large vocabulary requires extensive experience reading books filled with words the struggling reader does not know. For many students, breaking this vicious circle requires more practice than schools can provide. The investigators will develop a series of computer-managed instructional activities that will help students who have limited vocabularies acquire the substantially larger vocabularies necessary for high-level comprehension. They will evaluate the effects of these computer-based instructional activities on the enlargement of students' vocabularies in middle school, high school, and college students.

University of Memphis
Principal Investigator: Dr. Danielle McNamara
Coh-metrix: Automated cohesion and coherence scores to predict text readability and facilitate comprehension
The long-term goal of this research team is to improve reading comprehension in classrooms by providing tools to improve textbook writing and more appropriately match textbooks to the intended students. The current practice of determining the reading-level of textbooks does not reflect scientific advances in understanding what makes written text understandable. This research team plans to develop two automated tools (Coh-Metrix and Coh-GIT) that will enable writers, editors, and educators to more accurately estimate the appropriateness of a text for their audience, and to pinpoint specific problems with the text. Using these tools, the researchers will experimentally examine the effects of text cohesion on reading comprehension with respect to reader aptitudes (e.g., prior knowledge, reading ability, and motivation) in 3rd to 5th grade students and college undergraduates.

The Pennsylvania State University
Principal Investigator: Bonnie Meyer
Intelligent Tutoring Using the Structure Strategy to Improve Reading Comprehension of Middle School Students
Some students fail to succeed in identifying main ideas from expository text and giving cohesive and complete accounts of what they read because of how they read. The investigators will address this reading comprehension problem through a web-based intelligent tutoring intervention for middle school students. The web-based intelligent tutor will teach students how to use text structures strategically when reading to support understanding and memory and will guide them through the process of identifying the main ideas.

Carnegie Mellon University
Principal Investigator: James Callan
Reader-Specific Lexical Practice for Improved Reading Comprehension
Providing individually tailored reading practice may be the best way to support the development of reading comprehension. However, teachers are often not able to create individual reading lessons for each of their 20 to 30 students. Using recent improvements in computer science, this research project will develop a search engine tailored for selecting text passages that meet very detailed student information needs, for example texts on a particular topic, at a specific level of difficulty, and exhibiting desired vocabulary patterns. The research will also develop a software application that identifies reading material using the Web that is tailored to each student's individual interests and reading level.

Northern Illinois University
Principal Investigator: Dr. M. Anne Britt
Improving students' comprehension and construction of arguments
High school and college students are expected to learn to comprehend and evaluate written arguments. Recent assessments, however, show that most students lack such skills (National Assessment of Educational Progress, 1996, 1998). The primary objective of this study is to develop and evaluate the effectiveness of an instructional program for teaching students to better comprehend and produce arguments using a Web-based tutoring system.

University of California, Los Angeles
Principal Investigator: Dr. Robert Bjork
Introducing desirable difficulties for educational applications in science
Laboratory research indicates that in many cases, interventions that appear to make learning more difficult and slow the rate of learning can actually be effective in enhancing long-term retention of information. The goal of this research is to determine whether the benefits of these "desirable difficulties" demonstrated in laboratory tasks can generalize to realistic educational materials and contexts involving middle school and college students using the Web-Based Inquiry Science Environment (WISE) program.

Columbia University
Principal Investigator: Janet Metcalfe
Study Enhancement Based on Principles of Cognitive Science
Using a highly flexible and effective computer-based study program based on principles of cognitive science and designed to specifically target and improve memory and learning, this

research team seeks to improve academic performance by changing the way children approach studying. The computer-based tutor will be tested with a group of urban inner-city sixth and seventh grade children study academic content.

Washington University
Principal Investigator: Henry Roediger, III
Test-Enhanced Learning
This project provides a new approach to learning, memory and comprehension of written material. Traditional studies in educational psychology emphasize the way material is organized and/or study strategies during learning. In contrast, the present approach emphasizes the power of testing in enhancing learning, and examines the effectiveness of using testing as a learning tool in a Web-based university course.

Carnegie Mellon University
Principal Investigator: John Anderson
The Neural Markers of Effective Learning
Failure to learn the mathematics necessary for success in algebra is widespread. At the same time, success in algebra is considered the gatekeeper to pursuing careers in mathematics and science. This research team will use brain imaging to improve the design of a computer-based instructional approach to teaching key algebraic concepts. Over the course of the research, the cognitive computer tutor for algebra word problems will be substantially modified, refined and improved. The effectiveness of the tutor will be evaluated by assessing student gains on the class of word problems used in the curriculum as well as transfer problems that generalize the relationships in the word problems.

University of Maryland, College Park
Principal Investigator: Thomas Nelson
Computer-Assisted Instruction for Learning and Long-Term Retention Based on Recent Cognitive and Metacognitive Findings
The main focus of this project is to improve computer-assisted instruction (CAI) designed facilitate the learning and long-term retention of second-language vocabulary. This newly developed second-language CAI will use individuals' prior learning patterns and judgments of learning in order to create a highly effective and individualized computer [tutor] that can be used by both children and adults who are second-language learners.

LessonLab, Inc.
Principal Investigator: James Stigler
Improving Achievement by Maintaining the Learning Potential of Rich Mathematics Problems: An Experimental Study of a Video- and Internet-Based Professional Development Program
International comparisons indicate that middle school students in the United States are outperformed in mathematics achievement by students in many other countries. U.S. mathematics lessons rarely involve discussions of rich mathematical problems, in sharp contrast to lessons in the higher achieving countries, which participated in the TIMSS 1999 Video Study (Hiebert et al., 2003). We will create a video- and Internet-based professional development (PD) program in which middle school pre-algebra teachers learn to identify, design, and incorporate mathematically rich problems in ways that retain their rich learning opportunities for students.

University of Texas Health Center

Principal Investigator: Susan Landry
Scaling Up a Language and Literacy Development Program at the Pre-Kindergarten Level
Providing effective professional development to teachers in a way that improves their knowledge and skills but is convenient for the working teacher is a challenge. This study will examine the effectiveness of an on-line early literacy professional development model for early childhood teachers. This project promises to contribute to our knowledge of technologically supported teacher professional development.

University of Texas Health Science Center
Principal Investigator: Barbara Foorman
Scaling Up an Assessment-Driven Intervention Using the Internet and Hand-held Computers
Teachers are challenged to provide instruction that meets the individual needs of their students, but how can they accurately and efficiently assess and monitor each student's learning? This research team investigates the effectiveness of an intervention that uses the Internet and hand-held computers to help teachers link results from reading inventories to instructional practice. This intervention is designed to help teachers make connections between assessment and instruction that will produce significant improvements in student achievement.

Southern Methodist University
Principal Investigator: Patricia Mathes
Scaling-up Effective Intervention for Preventing Reading Difficulties in Young Children
Perhaps the greatest tragedy in education today is that we are not exploiting what is known about reducing the incidence of reading failure. Success or failure in learning to read in the early grades essentially determines a child's educational trajectory. Research has repeatedly demonstrated that early literacy intervention can interrupt this cycle of failure. This research team will study the relative effectiveness of approaches to teaching reading when intervention teachers are provided with differing models of ongoing professional development that take advantage of using sophisticated computer-based systems for delivery of content and high-quality coaching.

University of California at Berkeley
Principal Investigator: Anne Cunningham
A Longitudinal Study of the Effectiveness of a PreK Multisensory Literacy Curriculum, Teacher Experience, and Professional Development
In the last fifteen years, significant progress has been made in identifying the developmental skills that prepare young children to read, and in identifying those children who are more at risk for reading difficulties. Recent evidence suggests that preparation of early literacy skills must occur prior to kindergarten entry. This study will examine the efficacy of the 'Ready, Set, Leap!' (RSL) literacy curriculum with at-risk preschool children. The RSL curriculum focuses on important literacy skills (e.g., phonemic awareness and the alphabetic principle) that are essential to reading success in the first grade. The RSL curriculum is an interactive approach to learning that uses multisensory technology (e.g., Leap Pad) and engaging literature to support literacy development. Preliminary research findings indicate that the program results in meaningful literacy learning outcomes for young children.

The Media Group of Connecticut, Inc.
Principal Investigator: Harvey Bellin

Remarkable Reading Machine: A Video/Electronic Media Training Program of Evidence-Based Interventions to Strengthen Emergent Literacy Skills of At-Risk Children from Low-Income Families in any Childcare Setting.

Too many children enter kindergarten unprepared to learn how to read. New research offers reliable emergent literacy interventions for at-risk preschoolers. But parents and caregivers most in need of this training are least likely to know it exists. This project will create a highly motivational video/electronic media-training program for children and their parents and/or caregivers. The resulting product will be a low-cost, easy-to-use, easily replicated, empirically-tested, evidence-based training program that will strengthen the emergent literacy skills of at-risk preschoolers from poor families in any childcare setting.

USteach, Inc.
Principal Investigator: Robert Berdan
Synchronized Multimedia E-Book Development for Reading Fluency and Comprehension
In this research and development project, the team will demonstrate improvement in children's reading fluency and comprehension through sustained interaction with computer-based multimedia e-books. Second and third graders will read e-books, and their reading performance will be compared to students reading without computer support or with another computer-based reading program.

Quantum Simulations, Inc.
Principal Investigator: Dale Holder
Phase II: Artificial Intelligence Software for Student Assessment in Chemistry
The goal of this project is to advance the state of the art in chemistry education software. The focus of this innovation is the development of meaningful interactive tutoring and assessment capabilities for chemistry problem solving. More than just assigning a grade, meaningful opportunities will be created to learn directly from the assessment itself. The technology will benefit *all* students; however, it is specifically targeted to help those of greatest need, such as students of average or marginal performance and students from historically underserved groups, by lowering barriers to accessing high-quality instructional software.

The NeuronFarm, LLC
Principal Investigator: Mina C. Johnson-Glenberg
Training the Tutors: Literacy e-courses
Literacy tutors have been very successful in positively affecting the outcomes of struggling readers. However, tutor training is, at present, both costly to deliver and highly variable in quality. In this project, we will develop a set of eight e-courses based on empirically verifies principles of learning and effective literacy instruction, and designed to improve tutor training. These e-courses should reach over a thousand tutors in the first year. At the same time, experiments embedded in the e-courses will enable us to evaluate the efficacy of interactivity and pop quizzes.